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Energy Efficient Virtual Machine Placement In Cloud

Verma Megha[1], Jignesh Vania[2]
[1]*Pursuing Master of Engineering in Computer Engineering*.*
[2]*Faculty in Department of Computer Science and Engineering*.*
**L.J.I.E.T., Ahmedabad, India*

Abstract- **Cloud Computing is the use of computing resources that are delivered as a service over a network. In cloud computing, there are many tasks required to be executed by the available resources to achieve best performance and maximum utilization of resources. Due to rapid increase in the number of data centres to provide the services to the users the power consumed and operational costs of them is going on increasing day by day. Due to high power consumption and continuous working is adding up to the green house effect. So there is a need to create an energy efficient system where the power consumption is less. Dynamic compare and balance algorithm does not consider load of server at VM allocation time. Proposed algorithm considers load of host at VM allocation time for maximum utilization of resources. Algorithm evaluates total load of server after VM allocation and if server becomes over loaded according to the evaluation then new server will be selected for VM allocation. To support green computing concept proposed algorithm also define mechanism to save energy. If evaluated total load is lower than the lower threshold value of server means server is under loaded then new server will be selected for VM allocation.**

Index Terms**—Cloud Computing, Energy management.**

I. INTRODUCTION

Cloud computing is type of computing which is based on sharing of multiple computing resources instead of local server or personal server to handle application[10]. There are several issues in cloud computing like security, privacy, compliance, sustainability, load balancing and energy saving. Distribution of load over shared pool of resources over internet is a biggest question. Suppose two or three servers are used to complete a work and one another mechanism is needed to determine which server should be used to assign a work, to determine which server is busy and which server is loaded. Some systems have to deal with the situation where servers are distributed over different geographical area [11]. This paper defines feasible approach for proper VM allocation and energy saving in cloud systems.

II. CLOUD COMPUTING

Cloud computing was mainly developed to enable computation within geographically distributed and different type of resources. There is not any specific definition of cloud but it can be defined as a collection of distributed computers which are able to provide on demand computational resources and services with the help of internet[10]. It provides services like IAAS, PAAS and SAAS to the geographically widespread customers. Well known example is Amazon Elastic Compute cloud which provides virtual computing environment, different configuration of CPU, processor and memory[12].

Cloud computing is one of the most emerging fields of the world. It follows "pay as you go" model. This means that you only need to pay for the services which you use. In today's scenario it is very costly to build up your own applications, software, infrastructure, etc. so cloud providers rent the users their services and cost effective way to use them.

The demand for services is increasing day by day due rapid growth and this has led to the formation of large data centers. Moreover these data centers consume very large amount of energy and power, so we need to find a solution for reducing the power consumption. Apart from this the very high power consumption has led to the increase in carbon-dioxide components in the atmosphere. As a result of this the green house effect has increased so we need to find some measures for decreasing the power consumption and environment friendly cloud computing.

III. APPROACHES

A. VM Allocation:

VM allocation is the process of creating VM instances on hosts that match the critical requirement like storage and memory, match configuration in software environment and requirements like availability zones of Saas providers[3]. For every new VM request, the main idea is that whenever user requests to start a VM, the servers which have already hosted VM will be selected first. All the hosts will be arranged in

decreasing order and amongst them the most utilized host will be selected and checked if it could accommodate the incoming request.

B. VM Selection:

The process of selecting which VM to be migrated is known as VM selection. The basic idea is to set the upper thresholds and lower thresholds and to keep overall CPU utilization. There are various approaches like minimization of migrations, highest potential growth, maximum correlation and random choice [4]. Though in my proposed approach there is no need of VM selection policy as the upper threshold will not be exceeded because of VM allocation. VM selection is required when on the overloaded host we have to select which VMs amongst the all have to be selected for migration.

C. VM Placement:

VM placement is the process of deciding where the virtual machine should be placed. It chooses the proper physical machine to host the virtual machine[8]. Various physical machines are to be assumed as bins and virtual machines as different objects to be placed on bins. The best efforts are made so that minimum number of physical machines are on at a same time.

D. VM Migration:

VM migration is defined as a process where the virtual machine is moved transparently from one physical machine to another. In such a process the application or virtual machine on the host is active during the transfer. Here the memory, data storage, network elements are transferred from one machine to another. Basically there are two ways of transferring memory from one physical machine to another which are discussed as below[5]: pre-copy migration and post-copy migration.

As observed it can say that the post-copy operation makes a good sense as the page is copied only one time whereas in pre-copy operation the same page has to be copied more than once if the page has been changed and dirty pages. The other thing is that the content of pre-copy is always latest and updated whereas post-copy doesn't have the same. The main point is that just in case if the target fails during migration then the pre-copy is capable of restoring the content whereas post-copy is not.

E. Other related work:

The allocation is done in two parts[2]. The admission of new requests and the placement of current allocation of VMs and then the current allocation optimization. The first part is considered as bin packing problem and solved using MBFD (modified best fit decreasing). All the VMs are sorted in decreasing order of current utilization and then the VM is allocated to the host which provides minimum power consumption.The second step is current allocation optimization. For this firstly the VM to be migrated is selected on the basis of Single Threshold (ST) or by setting both upper and lower threshold. Then chosen VM are placed on host using MBFD. For choosing VMs to b emigrated from host different policies like Minimization of Migrations (MM), Highest Potential Growth (HPG) or Random Choice (RC) can be used. Their future work includes setting utilization thresholds dynamically, consider multiple system resources, multi-core CPU architecture and decentralization of optimization algorithms.

In [6], the authors have proposed an approach to optimize the energy by selecting the best candidate of migrating virtual machine (VM) and best candidate for destination physical machine (PM) and have formed energy aware migration model and load dispatching model. The migration cost can be minimized by selecting the VM with smaller memory and larger CPU reservations. They have discussed about co-migration to decide the order of VMs. The VM having higher resource demand and performance are selected and hosted on PM whose resource demands meet available demands. This algorithm can attain lower migration latency and save energy.

A technique for dynamic consolidation of VMs based on adaptive thresholds is adopted[7]. The utilization thresholds are automatically adjusted based on the statistical analysis of the historical data which is collected during the lifetime of VMs. The distribution of CPU utilization is calculated over time such as mean and standard deviation. The upper and lower utilization thresholds are calculated and for DT algorithm the MM policy for VM selection is applied. The VM placement is seen as bin packing problem and MBFD is used for placement. They have focused on only CPU usage so I am going to consider memory resources as they also contribute to overall energy consumption.

F. Dynamic Compare and Balance Technique:

This algorithm (DCABA) was introduced in [1], it takes two threshold values. Current host load (H_load) defines which step will be executed next. Current host load is calculated as below:

- H_load = x (CPU usage) + y(RAM usage) + z(BW usage) Where x, y and z € [0, 1] and they are weight coefficients. Here used threshold values are calculated as below:
- Host_limit: it defines maximum capacity of host at which load host can perform with maximum efficiency.

- H_UTD (Upper threshold value of host): Host_limit * β, where β is weight coefficient which is selected by vendor.
- H_LTD (Lower threshold value of host): Host_limit * α, where α is weight coefficient which is selected by vendor.

Algorithms divides server optimization problem into two sections. First section distribute overload of current host using load balancing algorithm and second section reduces number of active host in network to support green computing concept [1] .

Part 1: Suppose there is a situation when load of host is more than upper threshold value which is predefined by the vendor, so host is considered as overloaded. So load balancing algorithm is applied to reduce extra load and to transfer extra load to another host. Here it is performed by Adaptive compare and balance algorithm technique. It finds another host which can handle extra load without being overloaded.

Part 2: Suppose there is a situation where load of host is less than lower threshold value of host which is predefined by vendor, so to transfer extra load to the other host server-consolidation algorithm is used. This is achieved by migration of virtual machines. It finds another host which can handle extra load without being overloaded.

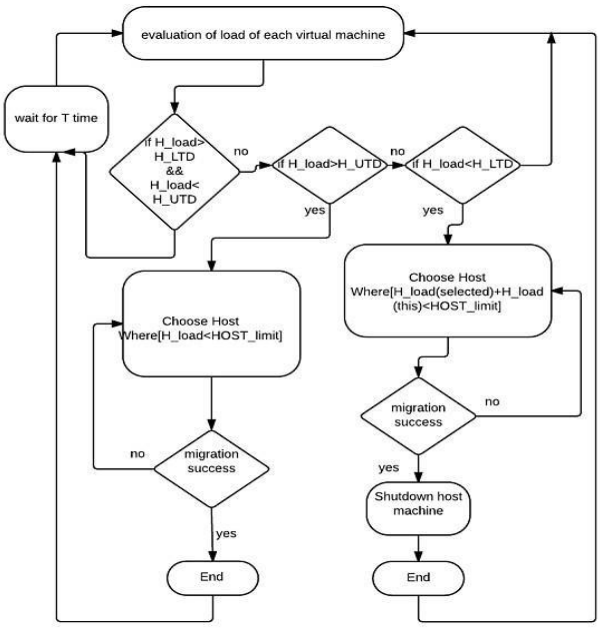

Fig. 1 Dynamic Compare and Balance Algorithm

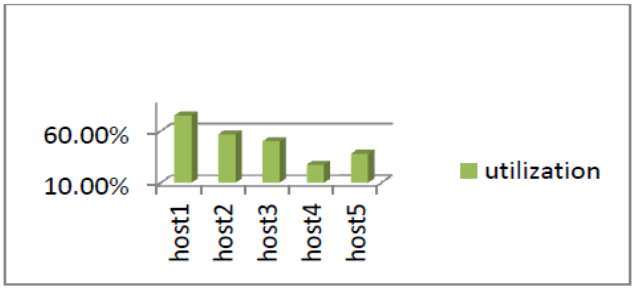

Fig. 2 Result of DCAB Algorithm

IV. PROPOSED WORK

Dynamic compare and balance algorithm does not consider load of server at VM allocation time. It simply allocates the VM to server and then at predefined time interval T it checks load of the server. According to server's overload or under load condition further steps are performed. If server is overloaded then load balancing is applied using adaptive compare and balance algorithm and if server is under loaded then server consolidation algorithm is applied to shutdown server. After both scenarios VM migration is performed to balance the load.

Proposed algorithm works on calculation of host load after VM allocation. If server becomes overloaded according to the calculation then VM will be created on different host. So it minimize the number of migrations due to host overloading conditions. Proposed algorithm also supports green computing by minimizing number of active hosts using server consolidation. Algorithm migrates VM from host if host is under loaded and try to minimize active number of hosts to save energy.

In the proposed algorithm the maximum utilization of host is done by allocating the incoming requests to the most efficient host to accommodate it.

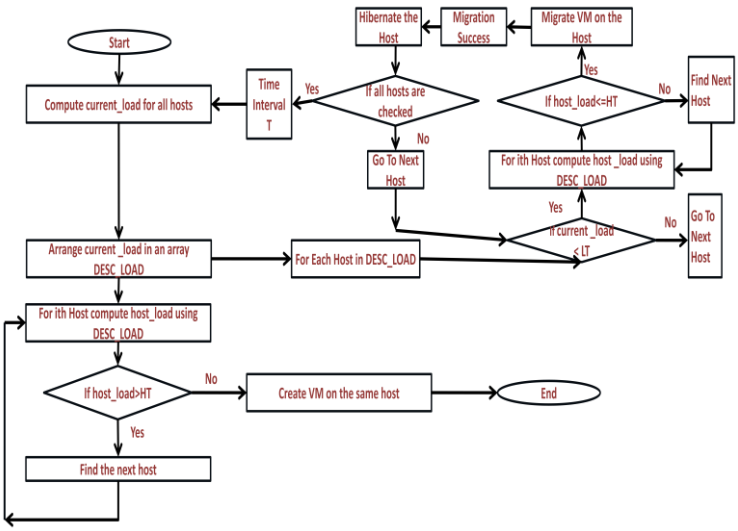

Fig. 3 Proposed Flowchart

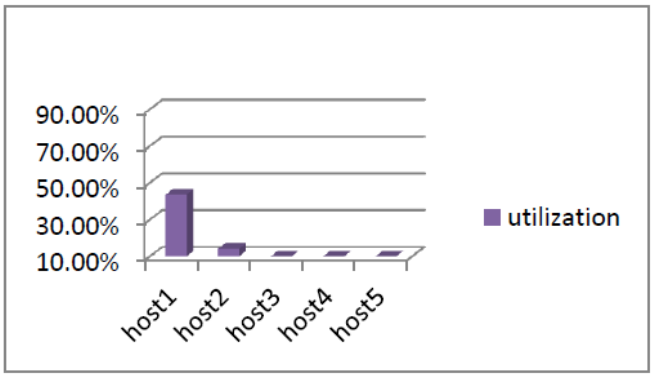

Fig. 4 Result of proposed algorithm

V. RESULT ANALYSIS & COMPARISON

All experiments are conducted in cloudsim simulator tool kit[]. Results clearly shows that proposed algorithm performs better than DCABA. Proposed algorithm reduces migration by checking host utilization before VM allocation. Proposed algorithm also supports green cloud computing by minimizing active hosts in cloud environment.

DCABA falls short due to the migrations and downtime during the migration. Proposed algorithm reduced migration due to the host overload by checking in advance that host is suitable for VM or not? If host have enough capacity to create and run new VM without being overloaded than only new VM will be allocated to it so overload condition of host cannot be happen. Proposed algorithm also migrates the VM from least loaded host to ideal host to make under loaded host free to shut down. Results clearly shows that proposed algorithm can save more energy with less time with respect to the DCABA.

CONCLUSION

This paper presents few approaches related to VM placement and the evaluation metrics and cost factors affecting VM migration. Due to increasing demands the energy saving techniques have gained popularity. The virtualization helps in this and idle servers can be shut down. Apart from this the source and destination machine can be identified for migration. Hence an effective use of resources can be helpful in achieving energy aware green computing. However the approach depends on the type of applications and demands.

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